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MS LALEH JALAI
KENYON & KENYON
1500 K STREET, N.W.-SUITE 700
WASHINGTON, DC 20005-1257

EXAMINER	
RUTHKOSKY, MARK	
ART UNIT	PAPER NUMBER
1745	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/232,498	MIZUNO, SEIJI	
	Examiner	Art Unit	
	Mark Ruthkosky	1745	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *16 December 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3-11,13 and 18-21* is/are pending in the application.

4a) Of the above claim(s) *18-21* is/are withdrawn from consideration.

5)☐ Claim(s) *4 and 9* is/are allowed.

6)☒ Claim(s) *1,3,5-8,10,11 and 13* is/are rejected.

7)☒ Claim(s) *1,3,5-8,10,11 and 13* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *3/17/2003*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Specification/New Matter

The amendment filed 12/16/2003 is objected to under 35 U.S.C. 132 because it introduces new matter into the disclosure. 35 U.S.C. 132 states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not supported by the original disclosure is as follows: the step of heat press forming the raw material into a mold "at a temperature that is equal or less than a temperature at which the epoxy resin and the phenolic resin are carbonized and completing manufacture of the separator while maintaining the temperature of the separator equal to or less than a temperature at which the epoxy resin and the phenolic resin are carbonized" is not taught in the specification. Further, the limitation of "completing manufacture of the separator while maintaining the temperature of the separator equal to or less than a temperature at which the epoxy resin and the phenolic resin are carbonized" in claims 10 and 13 is not taught in the specification. It is further noted that claim 13 includes the step of "heat press forming the raw material charged into the mold at a temperature which is equal or less than a temperature at which the resin is carbonized." This previous amendment was objected to as new matter in the final office action of 3/2003, however the applicant did not remove the unsupported, amended material in the subsequent amendment. The applicant states that this step is taught on page 20 of the specification; however, no process step is noted at a temperature that is equal or less than a temperature at which the epoxy resin and the phenolic resin are carbonized. The specification does discuss temperatures for the heat-pressing step; however, the specification does not teach in any step a temperature range that is equal or less than a temperature at which the epoxy resin and the phenolic resin are carbonized.

Applicant is required to cancel the new matter in the reply to this Office Action.

Election/Restrictions

Newly submitted claims 18-21 are directed to an invention that is independent or distinct from the invention originally claimed for the following reasons: The original claims are to a method of manufacturing a separator while the newly added claims are to a separator for a fuel cell.

Since applicant has received an action on the merits for the originally presented invention, this invention has been constructively elected by original presentation for prosecution on the merits. Accordingly, claims 18-21 are withdrawn from consideration as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.03.

Claim Rejections - 35 U.S.C. § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claim 13 is rejected under 35 U.S.C. 102(b) as being anticipated by Taylor (US 4,592,968.)

The instant claim is to a method of manufacturing a separator for a fuel cell comprising the steps of mixing a carbon, and a resin, charging the material into a mold, heat pressing the material and grinding a surface of the separator.

Taylor (US 4,592,968) teaches method of manufacturing a separator for a fuel cell comprising the steps of mixing a carbon, and a resin, charging the material into a mold, heat pressing the material and grinding a surface of the separator (see example 1, col. 8, lines 5-25.) The molding temperature in the example provided in col. 8 is 149 °C, which is in the range provided in the instant specification to be less than the carbonization temperature of the material. The completion of manufacturing grinding step is performed before carbonization of the separator plate. Thus, the claim is anticipated.

Claim Rejections - 35 U.S.C. § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 3, 5-8 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kougorou (JP 59042781.)

The instant claims are to a method of manufacturing a separator for a fuel cell comprising the steps of preparing a raw material by mixing carbon, an epoxy resin and a phenolic resin

wherein the epoxy resin is different from the phenolic resin and the ratio of the epoxy group in the epoxy resin to hydroxyl group of the phenolic resin is in the range of 0.8 to 1.2 such that the generation of reaction byproduct gas is minimized, charging the material into a predetermined mold and heat press forming the material.

Kougorou (JP 59042781, abstract) teaches a method for producing a separator plate for a fuel cell comprising the steps of mixing a carbon powder, an epoxy resin and a phenolic resin, charging the material into a mold and heat pressing (thermal pressure) the material. The specific example shows a paravinylphenol polymer (phenol) and a novolak type phenol resin initial condensate having an epoxy group (epoxy) added to graphite powder. Novolac phenol resins are disclosed. The carbon is graphite less than 100 microns in size. The loading of the material is done at a temperature that is in the range provided in the instant specification to be less than the carbonization temperature of the material. The material is heated to 180 and to 250 degrees Celsius to harden the molded body. The heat press-forming step is at a temperature that is equal or less than a temperature at which the materials are carbonized.

The reference is silent to the ratio of the epoxy group in the epoxy resin to hydroxyl group of the phenolic resin with regard to being in the range of 0.8 to 1.2. As the epoxy resin is reacted with the phenolic resin, one of ordinary skill in the art would choose to react the functional groups in about a 1:1 stoichiometry as the reaction will go to completion and form the desired product. As an increase in binder material is known in the art to decrease the conductivity of the separator plate, one of ordinary skill in the art would not add excess, unreacted binder material to the separator plate. Further, as the product of the reaction is desired as the binder material, one of ordinary skill would recognize from the teachings of Kougorou that

complete reaction between the epoxy resin and a phenolic resin would be desired in the process of making a separator plate.

Claims 3, 5 and 7-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kougorou (JP 59042781) in view of Sandelli et al. (US 4,643,956.)

Kougorou (JP 59042781, abstract) teaches a method for producing a separator plate for a fuel cell comprising the steps of mixing a carbon powder, an epoxy resin and a phenolic resin, charging the material into a mold and heat pressing (thermal pressure) the material. The reference does not teach the resins to be bisphenol A resin, a resol phenolic resin or the carbon material to be 5-50 μm in particle size. Sandelli et al. (US 4,643,956), however, teaches a process for producing a separator plate for fuel cells (col. 4 and examples) which includes an electrode substrate and separator assembly wherein the process includes supplying materials into a mold comprising a carbon (carbon particles of 50 microns or less, see col. 3, lines 1-50), and a binder. The includes phenol resins, such as resols, novolacs, (see claim 3, col. 3-4 and examples.) It would be obvious to one skilled in the art at the time the invention was made to use the phenol binder resins taught in Sandelli as the phenol binder material in the Kougorou (JP 59042781) separator plate or, alternatively to use the binder composition presented in Kougorou (JP 59042781) as the binder of Sandelli et al. (US 4,643,956) as the materials are shown to bind. carbon into a sturdy, conductive plate for fuel cell applications. JP 59042781 teaches the plate with this binder has improved chemical resistance, heat resistance and gas impermeability, which are features desirable for such a separator. The use of such carbonaceous plates as separators is well known in fuel cell assemblies.

Claims 1, 3, 5-8 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sandelli et al. (US 4,643,956), in view of Hidekuni (JP 08-151,461.)

Sandelli et al. (US 4,643,956) teaches a process for producing (col. 4 and examples) a separator plate for fuel cells which includes an electrode substrate and separator assembly where the process includes supplying materials into a mold comprising a carbon (carbon particles of 50 microns or less, see col. 3, lines 1-50), and a binder (can be phenol resins, including novolacs, see claim 3, col. 3-4 and examples.) The mold-pressing step is done at 300 °C (example.) The heat press-forming step is at a temperature that is equal or less than a temperature at which the materials are carbonized. While this process teaches the binder can be a mixture of phenolic resins, it does not teach a process for mixing phenolic resins and epoxy resins to form a separator (col. 20, line 10). Hidekuni (JP 08-151,461), however, teaches a process for producing a plate for fuel cells where the process includes supplying materials into a mold, wherein the materials comprise carbon (carbon particles of 5-25 microns are shown in paragraph 12), and a binder of phenolic and epoxy resins, to form a plate (can be phenol resins, including novolacs, see p. 13-16.) The amount of epoxy relative to the phenolic resin is 5-50%, which falls in the range of 1:1 (p. 33). Compression molding with heat is disclosed in p 29. The loading of the material is done at a temperature that is in the range provided in the instant specification to be less than the carbonization temperature of the material (see paragraphs 13-18 of JP '461).

It would be obvious to one skilled in the art at the time the invention was made to use the molding composition presented in JP 08-151,461 as the binder of Sandelli et al. (US 4,643,956) as the materials are shown to bind carbon into a smooth, porous conductive plate for fuel cell applications. The JP 08-151,461 teaches the plate has improved smoothness and porosity using

the method and binder described. One of ordinary skill in the art would have the knowledge to use such carbonaceous plates as separators for in fuel cell assemblies as the plates will provide desirable characteristics known in the art for such fuel cell stacks.

It is also obvious to one of ordinary skill in the art to use cresol novolak and bisphenol a type epoxy resins as the epoxy resin binder in a fuel cell, and resol phenolic resins as the phenol resin binder in a fuel cell. These specific resins are commonly used in the art as binders (see Hasegawa US 4,369,238, claim 2; and Sugaya US 5,128,378, col. 4, lines 60+ as examples.) for polymeric separators in electrochemical devices.

Claims 1, 3, 5-8 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kougorou (JP 59042781, abstract), in view of Hidekuni (JP 08-151,461.)

Kougorou (JP 59042781, abstract) teaches a method for producing a separator plate for a fuel cell comprising the steps of mixing a carbon powder, an epoxy resin and a phenolic resin, charging the material into a mold and heat pressing (thermal pressure) the material. The specific example shows a paravinylphenol polymer (phenol) and a novolak type phenol resin initial condensate having an epoxy group (epoxy) added to graphite powder. Novolac phenol resins are disclosed. The carbon is graphite less than 100 microns in size. The loading of the material is done at a temperature that is in the range provided in the instant specification to be less than the carbonization temperature of the material. The material is heated to 180 and to 250 degrees Celsius to harden the molded body. The heat press-forming step is at a temperature that is equal or less than a temperature at which the materials are carbonized.

The reference is silent to the ratio of the epoxy group in the epoxy resin to hydroxyl group of the phenolic resin with regard to being in the range of 0.8 to 1.2. Hidekuni (JP 08-

151,461), however, teaches a process for producing a plate for fuel cells where the process includes supplying materials into a mold, wherein the materials comprise carbon (carbon particles of 5-25 microns are shown in paragraph 12), and a binder of phenolic and epoxy resins, to form a plate (can be phenol resins, including novolacs, see p. 13-16.) The amount of epoxy relative to the phenolic resin is 5-50%, which falls in the range of 1:1 (p. 33). Compression molding with heat is disclosed in p 29. The loading of the material is done at a temperature that is in the range provided in the instant specification to be less than the carbonization temperature of the material (see paragraphs 13-18 of JP '461).

It would be obvious to one skilled in the art at the time the invention was made to use the molding composition presented in JP 08-151,461 as the binder of Kougorou (JP 59042781, abstract) as equivalent materials are shown to bind carbon into a smooth, porous conductive plate for fuel cell applications. JP 08-151,461 teaches the plate has improved smoothness and porosity using the method and binder described. One of ordinary skill in the art would have the knowledge to use such carbonaceous plates as separators for in fuel cell assemblies as the plates will provide desirable characteristics known in the art for such fuel cell stacks. As the materials of JP 08-151,461 are reacted in a range of 0.8-1:1, it would be obvious to use the same ratio of materials in the Kougorou (JP 59042781, abstract) separator as the material is shown to bind the carbon into a conductive plate. As the epoxy resin is reacted with the phenolic resin, one of ordinary skill in the art would choose to react the functional groups in about a 1:1 stoichiometry as the reaction will go to completion and form the desired product. As an increase in binder material is known in the art to decrease the conductivity of the separator plate, one of ordinary skill in the art would not add excess, unreacted binder material to the separator plate. In

addition, as the product of the reaction is desired as the binder material, one of ordinary skill would recognize from the teachings of Kougorou that complete reaction between the epoxy resin and a phenolic resin would be desired in the process of making a separator plate. It is further obvious to one of ordinary skill in the art to use cresol novolak and bisphenol a type epoxy resins as the epoxy resin binder in a fuel cell, and resol phenolic resins as the phenol resin binder in a fuel cell. These specific resins are commonly used in the art as binders (see Hasegawa US 4,369,238, claim 2; and Sugaya US 5,128,378, col. 4, lines 60+ as examples.) for polymeric separators in electrochemical devices.

Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sandelli et al. (US 4,643,956) or Kougorou (JP 59042781, abstract), in view of JP 08-151,461 and further in view of Taylor (US 4,592,968).

The teachings of Sandelli et al. (US 4,643,956) and JP 08-151,461 have been previously described. The loading of the material is done at a temperature that is in the range provided in the instant specification to be less than the carbonization temperature of the material. The references do not teach the grinding of the fuel cell plates in order to remove the surface layer that is in contact with the mold. Taylor (US 4,592,968), however, teaches method of manufacturing a separator for a fuel cell comprising the steps of mixing a carbon, and a resin, charging the material into a mold, heat pressing the material and grinding a surface of the separator (see example 1, col. 8, lines 5-25.) The molding temperature in the example provided in col. 8 is 149 °C, which is in the range provided in the instant specification to be less than the carbonization temperature of the material. It would be obvious to one skilled in the art at the time the invention was made to grind the surface layer of the plate in order to remove impurities

from the surfaces and provide a uniform thickness. One of ordinary skill in the art has the knowledge to grind the surface as taught by Taylor.

Allowable Subject Matter

Claims 4 and 9 are allowed.

The following is an examiner's statement of reasons for allowance:

With regard to claim 4, which is to a method of manufacturing a separator for a fuel cell comprising the steps of mixing a carbon, and a resin, charging the material into a mold, heat pressing the material and grinding a surface of the separator. The claim includes the limitation of glycidylamine as the epoxy resin. The most pertinent prior art has been noted in the claims. The prior art dos not teach this method including glycidylamine as the epoxy resin of the separator.

With regard to claim 9, which is to a method of manufacturing a separator for a fuel cell comprising the steps of mixing a carbon, and a resin, charging the material into a mold, heat pressing the material and grinding a surface of the separator. The method step includes preparing a slurry with resin particles with specific sizes and particle size distributions that are prepared by spraying and drying the slurry. The most pertinent prior art has been noted in the claims. The prior art dos not teach this method including the step of preparing a slurry with resin particles with specific sizes and particle size distributions which are accomplished by spraying and drying the slurry. Thus, these claims are allowed.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue

fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance.

Response to Arguments

Applicant's arguments filed 12/16/2003 have been fully considered but they are not persuasive. In addition, new rejections are presented. It is noted that the applicant's addition of the limitation of "a temperature that is equal or less than a temperature at which the epoxy resin and the phenolic resin are carbonized" is not taught in the specification.

With regard to the rejection under 35 U.S.C. 102 over Taylor, the applicant argues that Taylor teaches carbonizing the separator material. It is noted that the claim states, 'completing manufacture of the separator while maintaining the temperature of the separator *equal* or less than a temperature at which the epoxy resin and the phenolic resin are carbonized. Taylor (US 4,592,968) teaches method of manufacturing a separator for a fuel cell where the molding temperature in the example provided in col. 8 is 149 °C, which is in the range provided in the instant specification to be less than the carbonization temperature of the material. After the separator plated is formed, the plate is carbonized at higher temperatures. These temperatures are considered equal to the temperature at which the epoxy resin and the phenolic resin are carbonized and therefore the reference reads upon the claim.

With regard to the rejection under 35 U.S.C. 103 with regard to Sandenelli (US 4,643,956), JP 59042781, and JP 08-151,461, the applicant argues that a 1:1 stoichiometry of reactants is not supported. The JP '461 reference does show a ratio of epoxy relative to the phenolic resin is 5-50%, which falls in the range of 1:1 (p. 33). The applicant does not

persuasively argue that this ratio would not be obvious to one of ordinary skill in the art. The applicant further does not provide unexpected results for the claimed range of 0.8 to 1.2. Further, one of ordinary skill in the art would understand that for a reaction to go to completion the proper stochiometry of reactions would be necessary and in this example, a 1:1 ration would provide a complete reaction between the resins.

The applicant further argues that the prior art does not disclose that the ratio of binder components was not set in order to minimize gas production due to incomplete mutual epoxy and phenolic resin composition. This is not the criterion for obviousness and the examiner has provided both support and motivation in the prior art to adjust the relative amounts of binder materials in the separator plate. As such, the arguments filed 12/16/2002 have been fully considered but they are not persuasive.

Examiner Correspondence

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mark Ruthkosky whose telephone number is 571-272-1291. The examiner can normally be reached on FLEX schedule (generally, Monday-Thursday from 9:00-6:30.) If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached at 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished

applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Mark Ruthkosky
Primary Patent Examiner
Art Unit 1745

2/17/04